

including, for example, ISM and government radiolocation applications. Under such circumstances, Metricom respectfully submits that it is incumbent on the Commission to satisfy itself that if the Commission creates LMS using Teletrac's system architecture, LMS will, in fact, be robust enough to be usable by the American public.

30. Teletrac's Petition specifies that in order for its technology to be usable, its technology needs an extraordinarily quiet RF environment over a very large area.^{21/} This, alone, should give the Commission pause since LMS will not be the only primary user of this band and will be required to share the

equipment. For example, peak emissions of some ISM heating equipment may drift throughout much of the ISM frequencies because Part 18 does not require the same degree of frequency stability imposed on most communications transmitters by other parts of the FCC's rules.

32. Thus, under the Commission's original criteria in its Notice of Inquiry concerning AVM^{22/}, it must make a determination as to whether the Teletrac wide-band system performs "most effectively." Metricom submits that it does not.

IV. IF THE FCC IS INTENT UPON CREATING LMS IN THE 902-928 BAND, IT SHOULD DO SO ONLY PURSUANT TO SUCH TECHNICAL STANDARDS AS WILL PERMIT PART 15 OPERATIONS TO COEXIST WITH LMS IN THIS BAND

33. Because Teletrac's system is so fragile, Teletrac's Petition, at pages 26-32, asks the Commission to give Teletrac exclusive use of the bands at 904-912 MHz and 918-926 MHz by revoking the Commission's AVM spectrum-sharing policies. The Commission should not grant Teletrac's Petition in this regard because the existing sharing arrangement has worked well (except for Teletrac) and permitted operations in the band by a multitude of users, including Part 15 users. Therefore, the Commission should authorize LMS only on the condition that LMS is able to share the 902-928 MHz band with other licensed services as well as Part 15 services and devices.

^{22/} See ¶ 3, *supra*.

34. The Commission appears to be of this mind. Paragraph 21 of the Notice states: "The petitioner and some commenters claim that such systems [LMS systems] must be licensed on an exclusive basis (one licensee per band in any one geographic area) to operate effectively and to promote further development of the LMS industry. The record does not appear to support this view.... We believe it possible for wide-band pulse-ranging systems to operate on a non-exclusive basis, albeit with cooperation among co-channel licensees serving the same area. We further believe that non-exclusive licensing of LMS systems is the best means to promote competition within the LMS industry and continued technological advances in LMS services, possibly leading to more robust systems and more efficient spectrum sharing."^{23/}

35. As noted above, except for Teletrac, the existing sharing arrangement has worked well and permitted operations in the band by a multitude of users, licensed and unlicensed. These users have worked together to solve interference problems in the past and, if the Commission maintains a model for LMS like that which currently exists for AVM, these users will continue to resolve interference problems. However, the key to successful sharing is designing

^{23/} While Metricom applauds the Commission's intentions regarding a non-exclusive licensing scheme, Metricom (as noted above) does not believe that Teletrac's fragile system architecture can operate effectively on a non-exclusive basis with other LMS licensees or Part 15 devices. Therefore, as explained above, Metricom is concerned that the Commission will put itself in a position of embracing the Teletrac technology as the de facto technology for LMS.

sufficiently robust equipment that can survive in the shared-spectrum environment and that can flexibly accommodate other users as the FCC intended and apparently (See, paragraph 21 of the Notice) continues to intend. Every current user of the 902-928 MHz band, other than Teletrac, has apparently been able to design such robust equipment. Metricom believes the Commission should require Teletrac to do likewise by adopting technical standards that will permit Teletrac-type equipment to co-exist in the 902-928 MHz band. Not only would such standards allow the continued existence of Part 15 spread spectrum devices, it would assist Teletrac in assuring that its system was robust enough to withstand minimal interference and have a better chance of being successful in the marketplace.^{26/} Necessary standards for AVM equipment could be the subject of a further Notice of Proposed Rule Making.

36. The American public has been well-served by spectrum-sharing in the 902-928 MHz band. The current shared environment fostered by the FCC permits multiple entry and marketplace experimentation with several different technological approaches to perform a variety of functions. The public is thereby offered a choice of technologies to fill its needs. This was obviously the

^{26/} Because the Teletrac system is so susceptible to harmful interference its reliability is suspect. The system could be rendered useless by intentional or unintentional interference. If the system is so fragile, how can it gain acceptance by the public? Without assurances concerning the system's ability to operate under less than ideal circumstances, there will be no marketplace acceptance, systems will not be implemented, and frequencies could lay fallow.

purpose of the FCC's spectrum-sharing approach in this band, and it has worked. Metricom questions why the Notice threatens all these achievements.

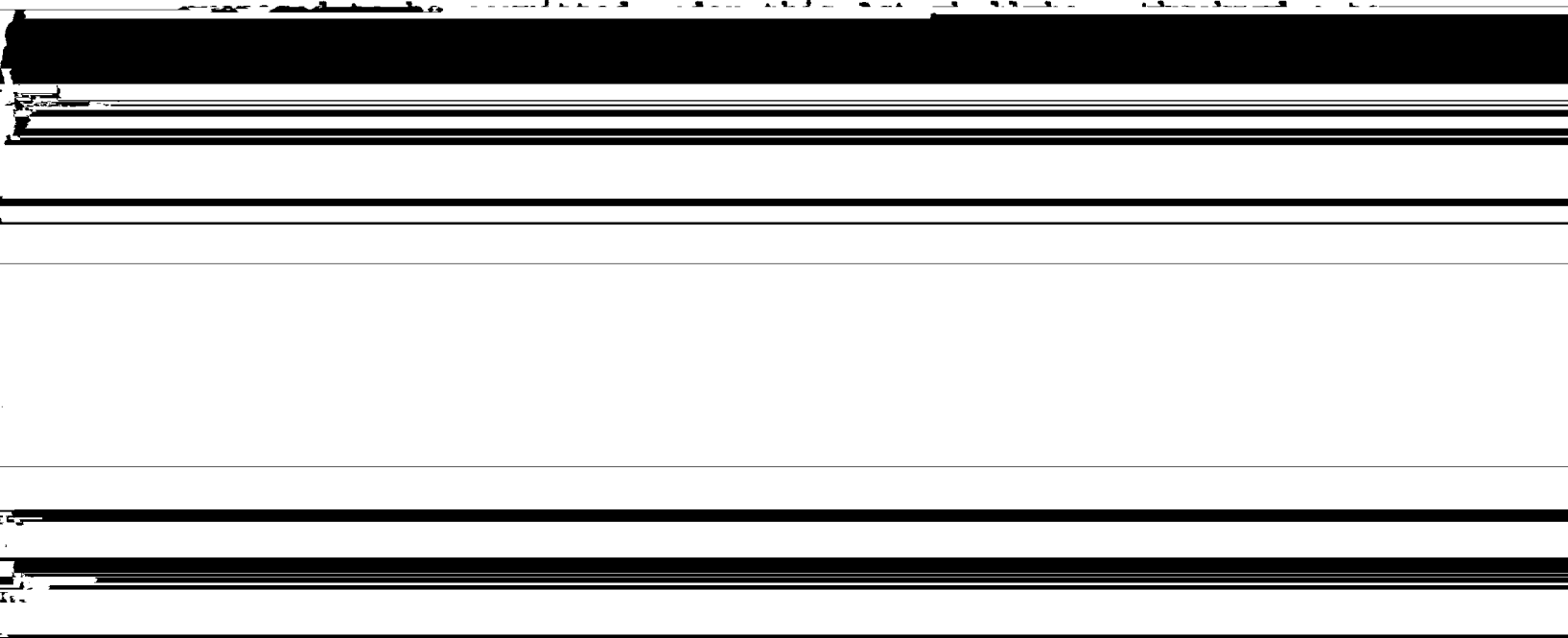
37. The 902-928 MHz band can support, and has supported, numerous applications of both licensed and unlicensed services that meet critical user needs and facilitate important national and local objectives. Continuing such a variety of applications will be severely limited if Teletrac is allocated exclusive use of most of the 902-928 MHz band. A flexible use policy is necessary in the 902-928 MHz band in order to minimize the disruption to uses that, while junior in the user hierarchy, nevertheless serve important functions. As Metricom has suggested above, before the Commission considers any exclusivity for Teletrac's technology, or any other technology, in the 902-928 MHz band, it should determine if such technology will be able to maintain a reasonable level of compatibility with users currently operating in the 902-928 MHz band and how the Commission will insure such exclusivity in a band currently in use by millions of unlicensed devices. Metricom believes that another Notice of Proposed Rule Making would be necessary to develop a record to adopt the type of standards Metricom has advocated in this part of its Comments.

V. MAKING TELETRAC'S TECHNOLOGY THE DE FACTO
LMS STANDARD VIOLATES THE COMMUNICATIONS ACT

38. As noted, Teletrac seeks exclusive use of the 902-928 MHz band due to the fragility of its system architecture. Such exclusivity is counter to the FCC's statutory mandate to promote

the development of new technologies^{25/} because, due to the fragility of the Teletrac system, sharing is infeasible and the Commission will have adopted one technology to the exclusion of all others. Such action is not necessary and will completely discourage the development of any new technologies to provide LMS. Such exclusivity is also counter to the FCC's statutory mandate to foster more effective use of radio^{26/} because the Teletrac technology will become the de facto standard for LMS in the 902-928 MHz band. Why should Teletrac invest in additional research and development to make its technology more spectrum-efficient if it not only has all the spectrum it needs to operate an inferior technology, but 4 MHz more than it needs to operate an inferior technology?^{27/}

39. Moreover, why should anyone attempt to develop a new technology to operate in this band if it is assigned exclusively to Teletrac's technology? Section 157 of the Communication Act (47 U.S.C. Sec. 157 (a) (1988)) states: "Any person or party (other than the Commission) who opposes a new technology or service



demonstrate why any other service in the band is contrary to the public interest. Because the Commission specifically rejects Teletrac's request for exclusivity and explicitly endorses the notion of a non-exclusive licensing scheme, the Commission by implication proposes the use of non-Teletrac (or "new") technology to provide LMS. Consequently, Teletrac must demonstrate that other

Dated: June 29, 1993

APPENDIX A

PART 15 TO AVM INTERFERENCE TECHNICAL ANALYSIS

1. The following technical analysis is provided in order to understand the potential for interference (whether harmful or not) from a Part 15.247 (spread spectrum) device to a wideband AVM system operating in the 902 to 928 MHz band. Since the present wideband AVM allocations are centered on 908 MHz and 922 MHz, the 908 MHz frequency will be used for analysis since, due to propagation losses, 908 MHz will represent the worst case for interference.

2. The type of receivers used for wideband AVM are direct sequence spread spectrum that make use of the time of arrival (TOA) and a form of triangulation for determining the position of a vehicle. The present systems that are on the air (most notably PacTel Teletrac) make use of about 4 MHz of spectrum centered at 908 MHz for the wideband transmissions from the vehicles to be located. The wideband transmissions are initiated by a high

BEST CASE - minimum range of potential interference to an AVM receiver

WORST CASE - maximum range of potential interference to an AVM receiver.

5. The Worst Case offender to the AVM system is the Part 15.247 (spread spectrum) device because those rules provide that the spread spectrum transmitter can operate with up to 1 watt of output power into a 6 dBi antenna, or 4 watts effective isotropic radiated power ("EIRP"). The Worst Case calculation will be considered first:

Worst Case Assumptions:

AVM wideband receiver sensitivity	-110 dBm
AVM receiver antenna gain (known systems are using 8 to 10 dB antennas)	10 dB
AVM receiver processing gain	10 dB
AVM receiver "interference threshold" (-110 sensitivity + 10 processing gain + 10 acceptable interference level)	-90 dBm
Part 15.247 transmitter power	1 watt (+30 dBm)
Part 15.247 antenna gain	6 dB
Frequency of interference	908 MHz

USING STANDARD PATH LOSS EQUATIONS^{1/}, THE WORST CASE
POTENTIAL INTERFERENCE RADIUS IS 104 MILES.

Best Case Assumptions:

AVM wideband receiver sensitivity	-100 dBm
AVM receiver antenna gain	8 dB
AVM receiver processing gain	20 dB
AVM receiver "interference threshold" (-100 sensitivity + 20 processing gain + 10 acceptable interference level)	-70 dBm
Part 15.247 transmitter power	1 watt (+30 dBm)
Part 15.247 antenna gain	6 dB
Frequency of interference	908 MHz

USING STANDARD PATH LOSS EQUATIONS, THE BEST CASE
POTENTIAL INTERFERENCE RADIUS IS 8.2 MILES.

^{1/} The path loss equation used was as follows:

$$R_p = 10 \log \left(\frac{T_p C^2 10^{\frac{G_t}{10}} 10^{\frac{G_r}{10}}}{.016 \pi^2 f^2 d^2} \right)$$

where